

**WHAT IS CLAIMED IS:**

1. A lithographic apparatus, comprising:
  - a radiation system configured to provide a beam of radiation;
  - a support structure configured to support a patterning device that imparts said beam of radiation with a desired pattern;
  - a substrate holder configured to hold a substrate;
  - a projection system configured to project said patterned beam of radiation onto a target portion of said substrate; and
  - a positioning system configured to maintain at least a first optical element and a second optical element in predetermined positions, said at least first and second optical elements being disposed in said radiation system and/or said illumination system, said positioning system comprising:
    - at least one position sensor that directly measures a relative position of at least said first optical element relative to said second optical element, wherein said positioning system maintains said first and second optical elements in a predetermined relative position.
2. The apparatus according to Claim 1, wherein said positioning system comprises at least one interferometric displacement measuring device for measuring at least the relative position and orientation of said first and second optical elements.
3. The apparatus according to Claim 2, wherein at least one of first and second optical elements has a rigid extension carrying a beam directing element for an interferometer beam.
4. The apparatus according to Claim 1, wherein at least one of the first and second optical elements contains a rigid extension reaching close to the other of said first and second optical elements, or an extension thereof, and said positioning system comprises at least one of an optical ruler, capacitive ruler, and analog capacitive sensor mounted on at least one of said rigid extension and said first and second optical

elements in order to measure the relative positions of said first and second optical elements.

5. The apparatus according to Claim 1, further comprising a reference frame and wherein said positioning system comprises a measuring device for measuring the position of said first optical element relative to said reference frame.

6. The apparatus according to Claim 5, wherein said positioning system comprises first and second actuators configured to respectively displace said first and second optical elements and first and second controllers configured to respectively control said first and second actuators, said first controller being responsive to the measured position of said first optical element relative to said reference frame and said second controller being responsive to the measured relative position of said first and second optical elements.

7. The apparatus according to Claim 5, wherein said positioning system comprises first and second actuators configured to respectively displace said first and second optical elements and first and second controllers configured to respectively control said first and second actuators, said first controller being responsive to the measured position of said first optical element relative to said reference frame and said second controller being responsive to a sum of the measured position of said first optical element relative to said reference frame and the measured relative position of said first and second optical elements.

8. The apparatus according to Claim 5, further comprising an additional displacement measuring device that measures the position of at least one of said support structure and said substrate holder relative to said reference frame.

9. The apparatus according to Claim 1, wherein said first and second optical elements comprise reflectors.

10. A device manufacturing method, comprising:

providing a substrate;

providing a beam of radiation using a radiation system;

imparting a desired pattern onto said beam of radiation;

projecting said patterned beam of radiation onto a target portion of said substrate via a projection system;

wherein a first optical element and a second optical element within said device are maintained in predetermined positions by:

directly measuring the relative positions of said first and second optical elements, and

controlling the positions of said first and second optical elements based on the direct measurement of their relative positions.

11. A lithographic positioning system, comprising:

at least a first optical element and a second optical element situated in predetermined positions;

at least one position sensor that directly measures a relative position of at least said first optical element relative to said second optical element;

a first actuator and a second actuator;

a first controller and a second controller configured to respectively control said first and second actuators, said first controller being responsive to the measured relative position of said first optical element and said second controller being responsive to the measured relative position of said first and second optical elements;

wherein said first and second actuators operate to maintain said first and second optical elements in a predetermined relative position.

12. The system according to Claim 11, further comprising at least one interferometric displacement measuring device for measuring at least the relative position and orientation of said first and second optical elements.

13. The system according to Claim 11, wherein at least one of first and second optical elements has a rigid extension carrying a beam directing element for an interferometer beam.

14. The system according to Claim 11, wherein at least one of the first and second optical elements contains a rigid extension reaching close to the other of said first and second optical elements, or an extension thereof.

15. The system according to Claim 14, further comprising at least one of an optical ruler, capacitive ruler, and analog capacitive sensor mounted on at least one of said rigid extension and said first and second optical elements in order to measure the relative positions of said first and second optical elements.

16. The system according to Claim 11, wherein said first and second optical elements comprise reflectors.